Cognitive Culture, Institutional Performance and Path Dependence

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Overview

Background: Culture

Dynamical/Complex Systems Approach

Institutional and Cognitive Path Dependence

Culture

Characteristic of a people

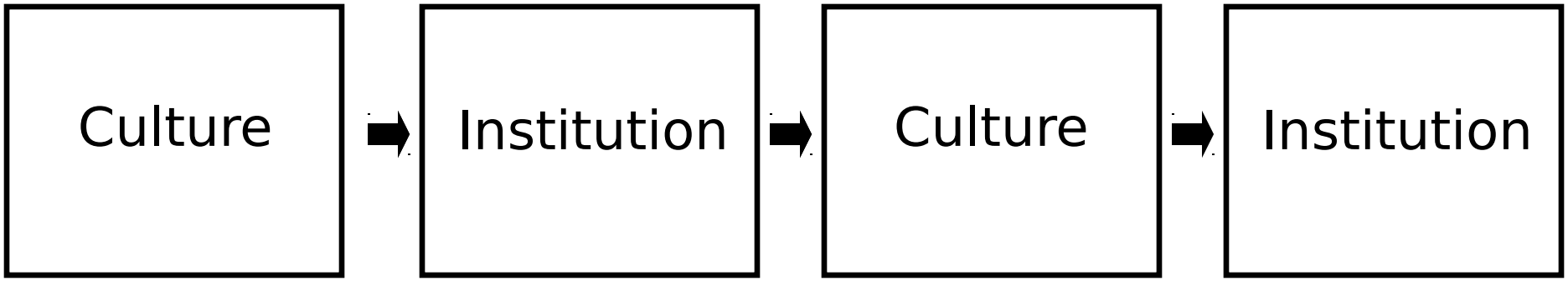
- Beliefs: trust
- Preferences: labor force, number of kids
- Risk taking: French Entrepreneurs
- Social Structure: Italy

Equilibrium Selection Criteria

Formal Models

Belief Systems: Ensminger
Preferences: Gintis, Boyd & Richardson
Representations: Batchelder, Hong & Page
Networks and Social Capital: Putnam, Kranton
Mental Models: Nisbett
Semiotics: Wedeen
Behavioral Routines: Bednar & Page

Institutional Path Dependence



Our Approach

Institution: Game Form

Culture: Cognitive structures in people’s heads

Our Petri Dish

Agents have cognitive representations

Initial distribution over those representations

Agents have a learning rule

Institution is a game form

Agents learn their way to an equilibrium

Culture: not an equilibrium selection device but determines the basin of attraction and the dynamics.

Path Dependence

Institutionally Path Dependent Cultures: The culture, C, depends upon the path of institutions.

Institutional Path Dependence: The choice over institutions depends upon past institutional choices.

NOTE: IPD Culture is weaker than IPD

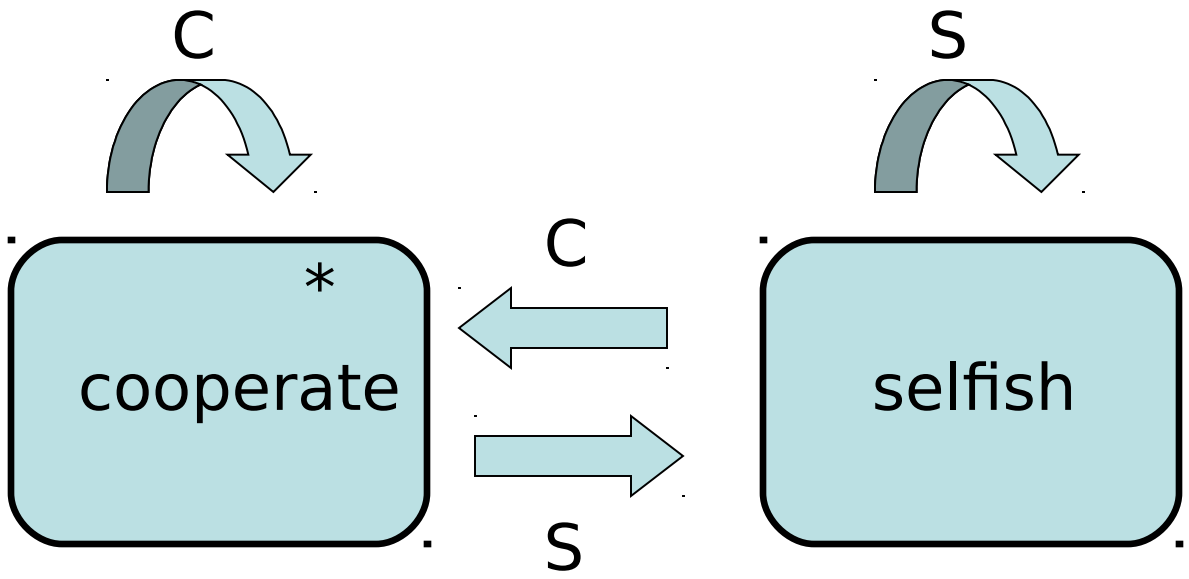
Game Ensemble Model

Agents encode strategies using automata

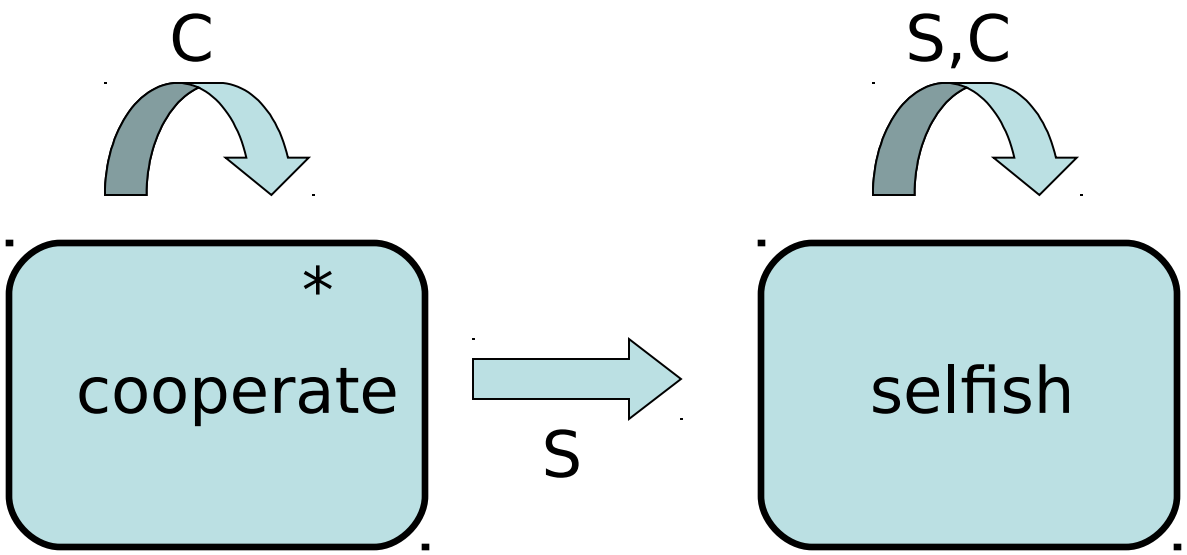
These automata have states, transition rules, and initial states

By having multiple initial states, the same automaton can play multiple games

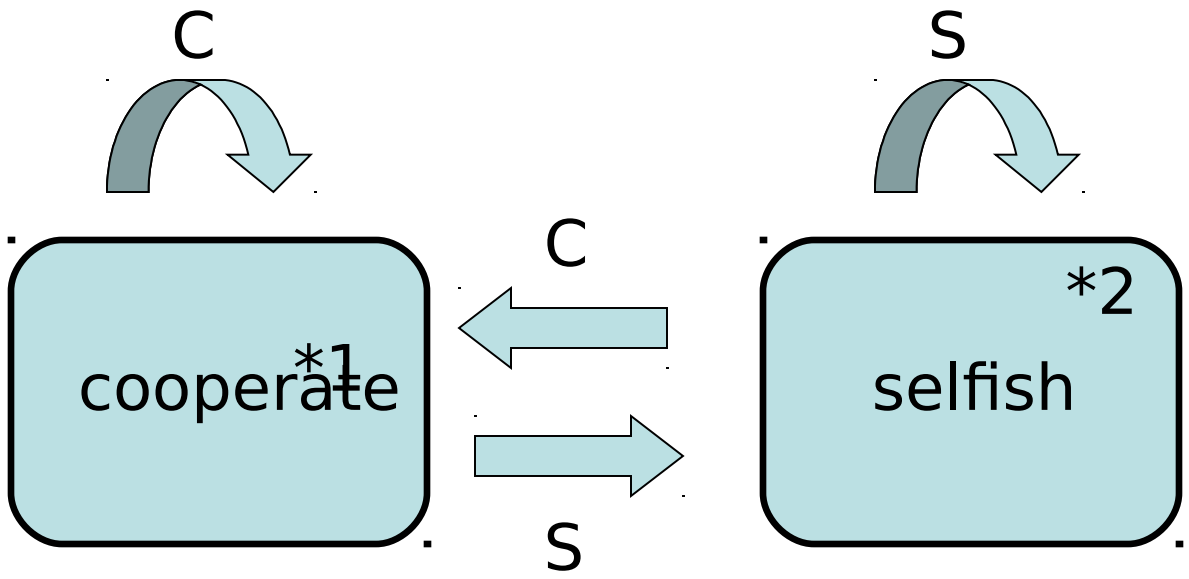
Example: Tit for Tat



Example: Grim Trigger



TFT & STFT



Game 1: TFT
Game 2: STFT

Automata, 0001, Integers

Initial State: 0 or 1

Action: C = 0, S = 1

Transitions: 0101 (transitions from CC, CS, SC, SS)

TFT 0 0 0101 1 0101

Each state has five binary digits that can be converted to an integer in {0,..31}

Write $x_1x_2x_3x_4x_5$ as $1x_1 + 2x_2 + 4x_3 + 8x_4 + 16x_5$

00110 = 6

Computational Model

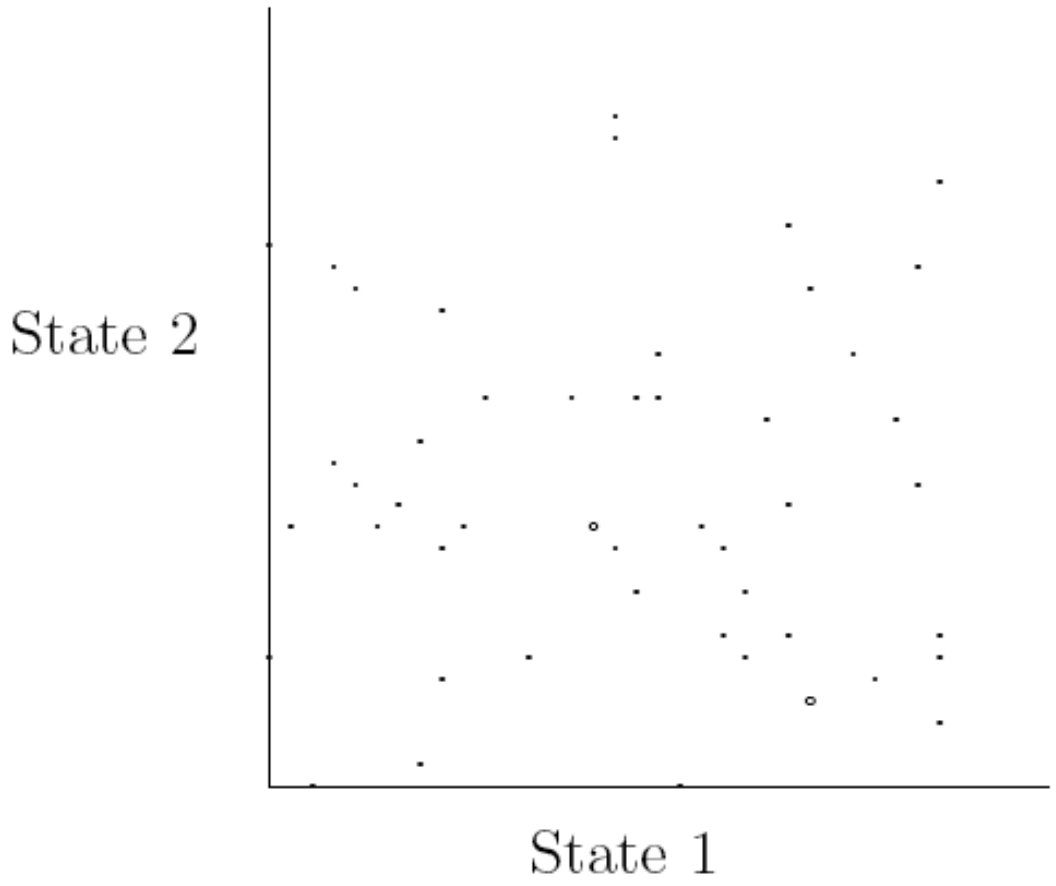
2N agents

N row agents and N column agents

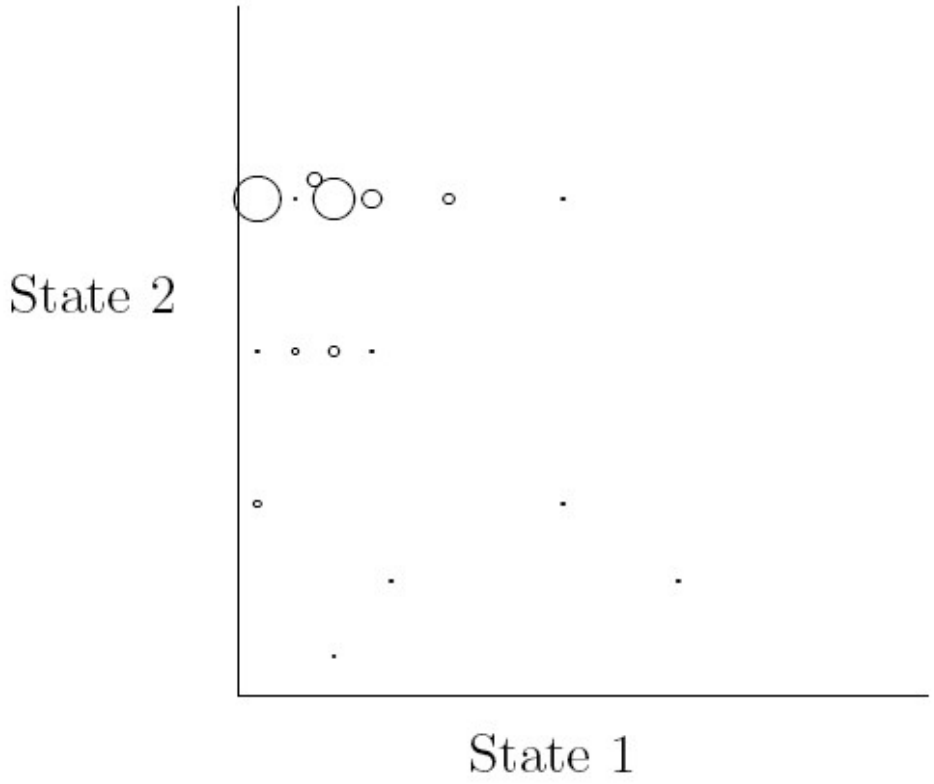
Each agent plays against five agents of other type

Agents learn individually and socially

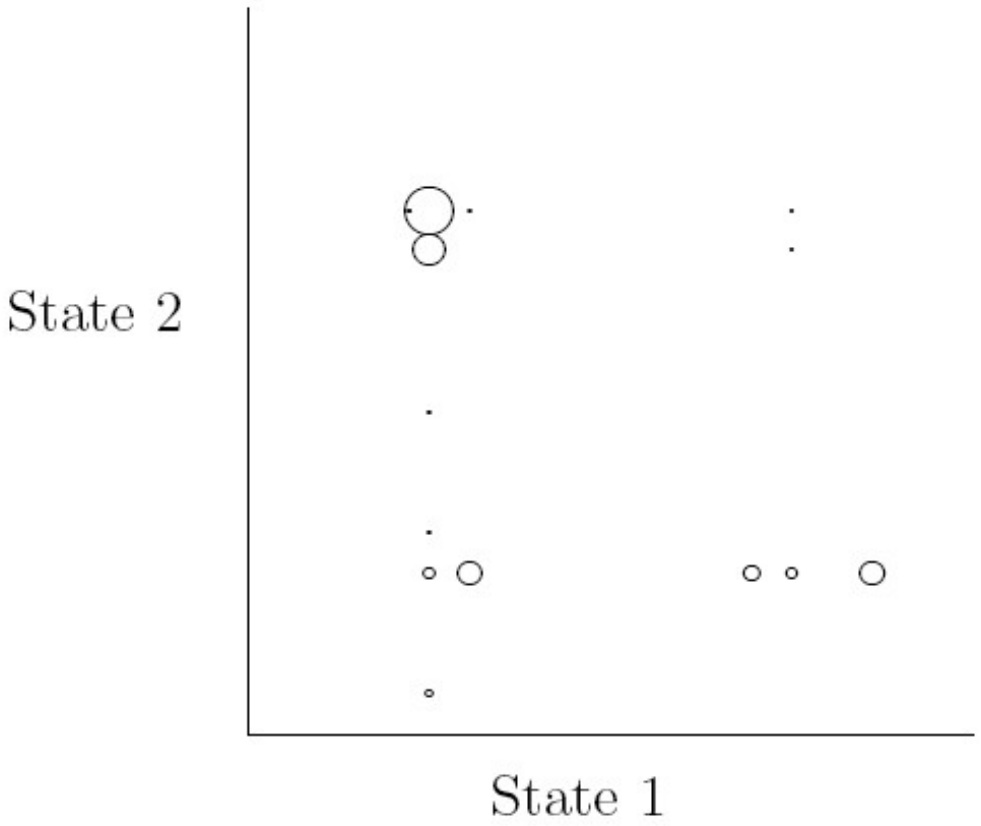
Initial Automata



Automata After PD Game



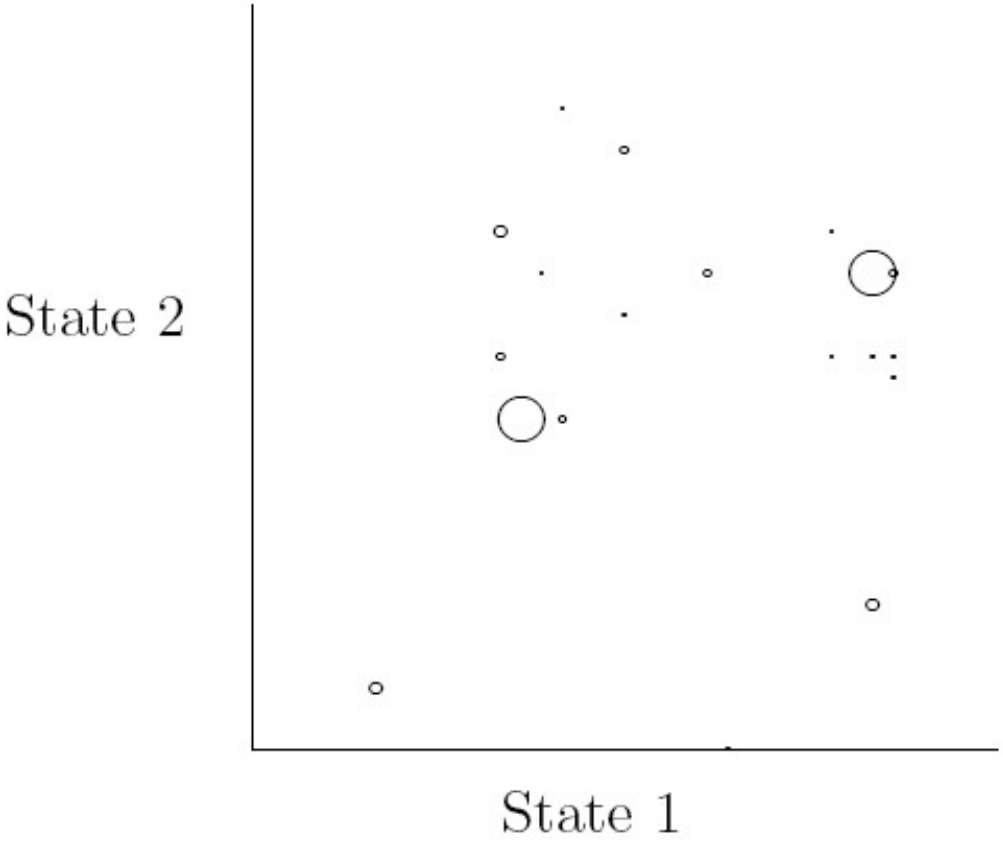
Automata After KE Game



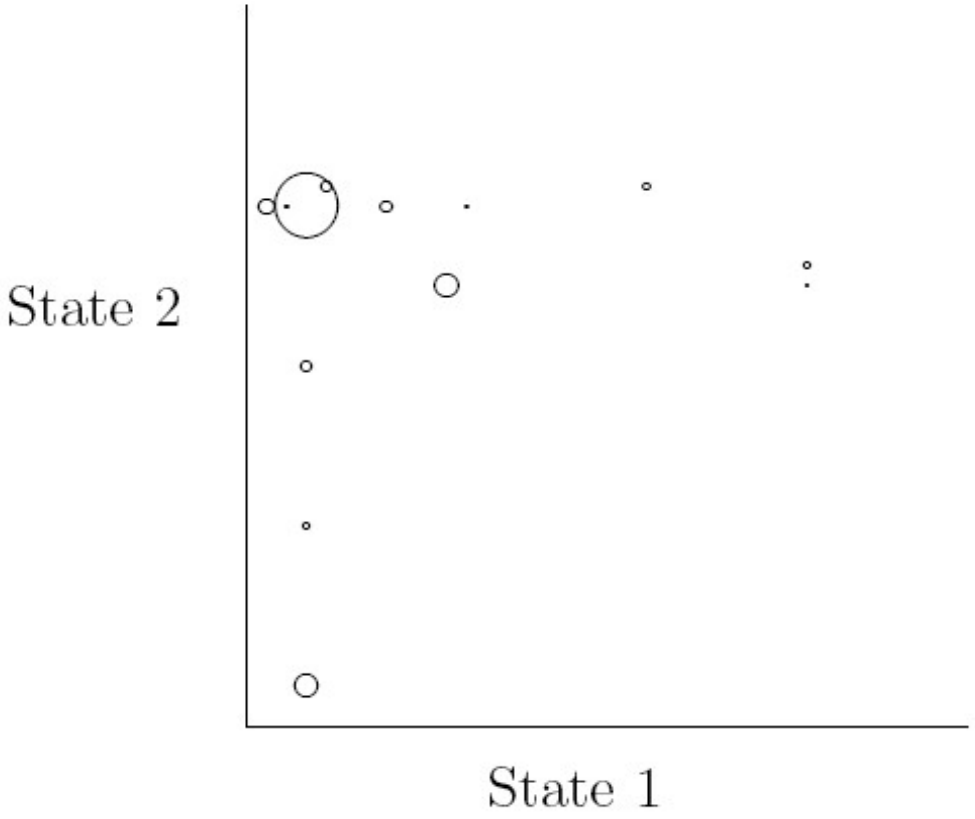
Single Game Outcomes

PD		CC
SI	SS	
KE		CS,SC (.8) SS (.1) CC (.1)
ALT		CS,SC (.85)
BL		SC
TR		CS

PD, PD & KE (CC)



KE, KE & PD (CC)



Post PD Outcomes

PD	CC	
SI SS		
KE	CC*	
ALT		CS,SC (.83)
BL	SC**	
TR	CS**	

* Different from single game

**Destroyed cooperation in PD

Post BL Outcomes

PD	SS*	
SI	SS	
KE	SS*	
ALT	SS*	
BL		SC
TR	CS	

* Different from single game

SI & PD vs PD & SI

	PD & SI		SI & PD
BL	SC (.5)	CC (.5)	SC
TR	CS (.5)	CC (.5)	CS

What’s Going On?

Play PD and then SI, you get lots of TFT strategies and these end up being stable about half of the time.

Play SI and then PD, you get Grim Trigger. These more easily become BL or TR.

Institutional Path Dependence

Culture should limit the set of possible paths as some game forms will not be as successful given the existing culture.

Meta Institutional Game

P1	P2	P3	P4	P5
PD	PD	TR	TR	AL
vs	vs	vs	vs	vs
TR	SI	AL	AL	SI

There are 32 possible paths, but only five of them are realizable.

TR,SI,TR,TR,SI

PD,X,AL,AL,X

Tests of Path Dependence

Create initial ensembles of three institutions and then look at the conditional probability over different future paths.

For example: (SI, PD, SI) vs (TR,TR,BL)

Summary

General theory of institutional path dependence and culture

Game ensembles is just one of many possible implementations of general theory

Extensions

Evolve networks and games simultaneously

More realistic institutions (markets, property rights)

Link to experiments (Yan Chen)

Link to better cognitive models (MIT - AI lab)

Metric on cultures